https://dx.doi.org/10.22161/ijaers.4.4.28 ISSN: 2349-6495(P) | 2456-1908(O)

Separation of Sediment Contents and Water from Crude Oil of Khurmala and Guwayer Oil Fields in Kurdistan Region by using Centrifuge Method

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Abstract*—The present research paper is aimed at determining water and sediment contents in crude oil by using centrifuge method in laboratory in which ASTM D 4007-02 is used to analyze the samples. Furthermore, water and sediment contents in crude oil should be removed because for custody transfer process purchasers prefer to pay only for crude oil and want to minimize the quantity of water and sediment contents in crude oil. Presence of water and sediment contents in crude oil creates problems such as corrosion of equipment when dealt in oil industry along with the problem of oil viscosity. We examined sixteen samples. Four samples were taken from Guwayer oil site area and remaining four from Khurmalla oil site area. These samples were analyzed properly at MNR laboratory in Kurdistan Region-Iraq. The crude oils is considered as the best if it contains less water and sediment content and the vice versa is for the worst quality of crude oil .The method is easy and sharp to check the quantity of sediments and water in crude oil samples in lab and this quantity helps to tell the quality of crude oil.*

***Keywords*—Crude Oil, Sediment content, Centrifuge method, Guwayer and Khurmala, Kurdistan region.**

I. INTRODUCTION

Crude oil is naturally occurring underground mixture which mainly contains hydrocarbons with some compounds of Oxygen, Sulphur and Nitrogen. Crude oil is known as petroleum in which petros comes from Greek word meaning rock or stones and oleum comes from Latin language meaning oil. Crude oil and its byproducts arecommonly used for fuel purposes and sometimes in medicines. It is regarded as a viscous liquid which contains sediment contents and water. However sometimes one or both are not present in crude oil. In case if both are present then it becomes necessary to remove sediment contents and water from crude oil because it leads to corrosion of equipment when dealt in oil industry besides effecting he quality of crude oil. It is worth to mention that the properties of crude oil are seriously effected in the presence of sediment content and water. Crude oil is considered to be the best if it is completely free or has very little amount of water or sediment contents Furthermore, the determination of sediment contents and water quantity is important to measure true net volumes of actual oil content in custody transfers, taxation, sales and exchanges. In addition, crude oil is also known as black gold in the world because in many ways our daily life activities heavily depend on crude oil. There are some known techniques which are in practice to determine water and sediment contents in crude oil. The centrifuge method is one of these techniques which is used to determine water and sediment contents in crude oil precisely in both, field and in laboratory.

Determining water and sediment content in crude oil either on site or inside laboratory is essential to custody transfer operations. The centrifuge method can be used on site and gives very accurate results if completed properly. The centrifuge method can also be used in side laboratory but handling or transporting samples may become more critical. (Williams,1990).

API (American Petroleum Institute) gravity is a unit which is used to rank the value of crude oil. The relationship between API gravity and density of crude oil are inversely related. More details about the relationship between API gravity, density and classification of crude oil (light, medium, heavy, and extra heavy) are shown in (Table 1). (Papavinasam, 2014).

1.1 Hydrocarbons

Basically, hydrocarbons are chemical species consisting only of hydrogen and carbon atoms. In addition, hydrocarbons occur naturally beneath the earth surface and are formed when organic matter such as the remains of animals or plants are compressed beneath the earth for a

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long period of time at a very high temperature and pressure. Hydrocarbons may exist under the earth surface either as gas or as liquid. However, liquid hydrocarbons are known as a crude oil, and gaseous hydrocarbons are known as natural gas. There are several kinds of hydrocarbons that are classified chemically but with respect to oil industry, there are three types which are more relevant here: Alkanes, aromatic compounds, and cycloalkanes. (Papavinasam, 2014).

1.2 Centrifuge machine

It is a machine that is used to separate or determine sediment content and water in crude oil (Figure 1), in which the separations appear as lines and can be seen easily. The machine consists of fourcone-shaped tubes which reads from 0 mL to 50 mL. Moreover, the separation lines usually startfrom water at the bottom to oil at the top of tubes and between water and oil contents of sediment as shown in (Figure 2).

Fig.1: Centrifuge Machine

Fig.2: Cone-Shaped Tube

II. METHODOLOGY

In this part, Chemical and instrumental methods are used to separate sediment contents and water from crude oil. The centrifuge machine which known as (ASTM D 4007-02) was used and the processes were carried out in the laboratory of MNR (Ministry of Natural Resources) Kurdistan, Iraq. All of samples were analyzed in laboratory. Prior to analyze, the samples should be mixed properly to bring it back to its original state because maybe the sample has been separated into layers while transported to laboratory. (Williams, 1990) .Each of these samples is analyzed by centrifuge technique which contains 25 mL of crude oil and 25 mL of Toluene with 4 or 5 drops of a demulsifier in centrifuge tubes, after heating water in beaker till the temperature reaches to 60 Celsius degree. The centrifuge tubes should be put in beaker of hot water with temperature of 60° C. After that, the temperature of crude oil samples reaches to 60°C and all centrifuge tubes are put in a centrifuge machine. Finally, each of these sixteen samples are separated from water, sediment contents and oil by measuring (or reading) from centrifuge tubes, and the separation lines between each component (sediment, water and oil) can be seen easily.

III. RESULTS AND DISCUSSION

Sixteen samples of crude oil (eight of them from Khurmalla and eight from Guwayer wells) were tested. After centrifugation of samples the data was obtained by measuring (or reading) the tubes level of each component in mLs. Water and sediment content appear below the tubes if present in crude oil. The first sample of crude oil is called "Slop (Khurmalla)". Sediment content in this sample is nil, which means sediment content is not present in the sample. Water content is noted as 0.05 mL in Slope (Khurmalla) sample. The total sediment content and water in this sample is found to be 0.05 mL and the rest is crude oil. (Shown in Table 2)

Table.1: Shows the result of crude oil samples after centrifugation at 60 C°.

No	**Samples (Mean of four)**	**Sediment content (mL)**	**Water (mL)**	**Total Water and Sediment Content (mL)**	**Crude oil (mL)**
1	Slop (Khurmalla)	Nil	0.05	0.05	99.95
2	Crude oil (Khurmalla)	Trace	5.2	5.2	94.8
3	Guwayer-3 well	1.0	0.3	1.3	98.7
4	Guwayer-2 well	12.5	12.5	25	75

Note: Each sample is the meanof four samples of same place.

The quality of first sample was found very good because the amount of water and sediment content is very less, corrosion does not occur while transporting due to low or no water and sediment content. The percentage of free

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crude oil is 99.95 mL with green color, which is very good to be sold in a high quality.

The second sample collected from Khurmalla oil field known as "Crude oil (Khurmalla)" was also analyzed in a similar way. Sediment content in this sample after reading through centrifuge tubes is tracedin minute quantity. Despite having trace sediment content in the sample, 5.2 mL water was also found in the sample. In conclusion , the total sediment content and water `in this sample is 5.2 mL and the rest is crude oil. (Shown in table 1).

The third sample collected from Guwayer oil site known as "Guwayer-3 well"was also analyzed. Water found in this sample in this sample after centrifugation is about 0.3 mL and sediment content of 1 mL as per readings of centrifuge tubes. The total sediment content and water is noted 1.3 mL and the rest which is about 98.7 mL is crude oil (Shown in table l).

The fourth and last sample collected from Guwayer oil site known as "Guwayer- 2 well" was also tested in a similar way. Water in this sample after centrifugation can be read as 12.5 mL and sediment content was found to be 12.5 mL. The total sediment content and water in this sample is 25 mL and the rest which is 75 mL is crude oil free of water and sediment. (Shown in table 1)

The difference in elevation is so clear due to high amounts of water and sediment content in crude oil. Sediment content is 12.5 mL and water is also 12.5 mL and they are in the same level. The total sediment content and water is becomes double (25 mL) and the line is rises up. At the end, free crude oil rises up and reaches up to 75 mL. This sample is definitely the worst one due to high amounts of water and sediment content and corrosion might occur if not handled properly.

The percentage of this sample is totally different from other samples. There are huge amounts of water and sediment contents in crude oil of Guwayer-2 well. The purple color of crude oil without water and sediment content contains 75 percent of this sample. The blue color is water which is 12.5 percent and the red color is due sediment content which is 12.5 percent of this sample of crude oil. The green color showing total sediment content and water is 25 percent of Guwayer-2 well crude oil sample. The quality of this crude oil is the worst one if compared with other three samples.

IV. CONCLUSION

To sum up, the Centrifuge method has been used to separate the water and sediment content from crude oil in laboratory. The results thus obtained are more accurate than the results obtained through other methods used for the separation of sediment contents and waterfrom crude oil. Significant difference has been noticed between the samples collected from two different oil fields. In addition, the worst sample of crude oil containing more water and sediment content is named as Guwayer-2 well and the best sample containing less water and sediment content in crude oil in this process is named as Slop (Khurmalla). As experienced from the procedure, the crude oils is considered as the best if it contains less water and sediment content and the vice versa is for the worst quality of crude oil. Therefore, to transport the crude oil through pipe lines, itis necessary to reduce the amount of water and sediment content from the crude oil in order to prevent corrosion.

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